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### 2000 Special Article - Measuring the impact of the new tax system on the September Quarter 2000 Consumer Price Index

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#### INTRODUCTION

The Consumer Price Index (CPI) measures final transaction prices, inclusive of indirect taxes. As such, the introduction of The New Tax System (TNTS) has had a direct impact on the CPI. The September Quarter 2000 CPI estimates were particularly affected by the introduction on 1 July 2000 of the goods and services tax (GST) and the concurrent removal of wholesale sales tax (WST).

Community feedback has shown that there is substantial interest in the ABS providing an answer to the question **What is the total impact of TNTS on the CPI?** The purpose of this article is to describe the ABS's efforts in answering this question, which unfortunately is one that cannot be answered precisely by statisticians.

Ideally one would want to construct a measure of price change that was totally free of the effects of tax change (which would enable the impact of tax change to be calculated by deduction). However, all of the generally accepted options available to statisticians are only able to provide a measure of the direct, or first-round, effects of TNTS on the CPI. None of the options can measure the second-round and subsequent (or flow-on) effects on final consumer prices of, for example, reductions in producer costs arising from the removal of WST on inputs and the extension of the fuel rebate scheme. To measure these flow-on effects would require extensive modelling of a type not undertaken by the ABS.

Of those options generally available to statisticians, the constant fiscal take measure (CFTM) provides the best measure of price change abstracting from the impact of changes in indirect taxes (notwithstanding its inability to take account of the impact of second-round effects). Compiling this measure requires an estimate of the dollar amount of tax in each price. For most taxes, other than the WST, the amount of tax is readily observable or estimable from known tax rates and final transaction prices. However, estimating the amount of WST in final prices would require additional price information (or information on margins) for a substantial number of items in the CPI. The ABS does not have this information so it cannot construct a CFTM.

The information available to the ABS does, however, support the construction of a less-preferable constant tax rate measure (CTRM). This measure has substantial qualifications, as it is based on the assumption that ad valorem taxes are levied in proportion to final transaction prices. In cases where ad valorem taxes levied at pricing points other than the final retail price (such as WST) are replaced by ad valorem taxes levied on retail prices (such as the GST), the CTRM would tend to overstate the non-tax component of price change and therefore understate the significance of tax change compared to the CFTM. Furthermore, the CTRM includes the effect of 'fiscal drag' that occurs when ad valorem tax rates are applied to changing pre-tax prices. Descriptions of the two

measures and a discussion of their limitations are provided in the Technical Note at the end of this article.

Because of the strong community interest in the question **What is the total impact of TNTS on the CPI?**, the ABS decided to compile the CTRM on an experimental basis. The decision was made reluctantly because, although the job of the ABS is to provide 'the approximate answers to the right questions', it was clear that the limitations associated with the measure seriously reduce its usefulness in answering this question.

## COMPILING A CONSTANT TAX RATE MEASURE

A CTRM seeks to answer the question **By how much would the CPI have increased if the tax rates on products had not changed?** The difference between the percentage movement in the CTRM and that in the CPI can provide an indication of the contribution of changes to tax rates to the overall movement in the CPI. The measure is constructed by holding explicit (or published) tax rates constant at those prevailing in the base period. For each item in the CPI, the price for the current period (i.e. September quarter 2000) is adjusted by multiplying it by the ratio of the ad valorem taxes in the base period (i.e. June quarter 2000) to those in the current period (both in mark-up form), then adding the specific taxes levied in the base period and subtracting those levied in the current period. The adjusted current period price is then compared to the base period price. The formula for the construction of the CTRM is provided in the Technical Note.

'Taxes' include all taxes levied on items included in the CPI with the exception, for practical reasons, of import duties. It is not practical to confine the measure to TNTS changes alone. While excise duty and wholesale sales tax are obvious inclusions, taxes also include items that are regarded as 'all tax' such as motor vehicle registration charges and general property rates. Subsidies such as the Medicare rebate and child care subsidies are regarded as negative taxes.

As mentioned above, the CTRM suffers from three significant limitations — it does not properly account for the removal of embedded taxes, WST is not treated correctly, and the effects of 'fiscal drag' are included.

Table 1 shows, for each CPI Group and for All groups, the percentage movements in the experimental CTRM between the June quarter 2000 and September quarter 2000, and the corresponding movements in the CPI.

**TABLE 1: EXPERIMENTAL CONSTANT TAX RATE MEASURE**

Group	% change June quarter 2000 to September quarter 2000 Change in points contribution		
	CPI	CTRM	CTRM
Food	1.7	-0.9	-0.20
Alcohol and tobacco	6.5	7.9	0.74
Clothing and footwear	7.4	0.1	0.00
Housing	6.1	0.5	0.11
Household furnishings, supplies and services	2.0	3.3	0.34
Health	0.5	0.2	0.01
Transportation	2.6	6.0	1.15
Communication	6.9	-2.8	-0.11
Recreation	4.0	2.5	0.38
Education	0.2	-0.5	-0.02
Miscellaneous	2.0	2.7	0.14
<b>All groups</b>	<b>3.7</b>	<b>2.0</b>	<b>2.50</b>

## PROBLEM WITH THE TREATMENT OF WST IN THE CONSTANT TAX RATE APPROACH

Taken at face value, the results would indicate that TNTS contributed 1.7 percentage points (or 46%) to the increase in the CPI in the September quarter 2000. However, the ABS considers this result to be implausibly low, due to the problem with the treatment of WST in the CTRM, which is described in detail in the Technical Note. It is also inconsistent with estimates made by many economic commentators who have suggested that, based on a range of extrapolative and survey techniques, TNTS is likely to have contributed 2½ – 3 percentage points to the CPI increase in the September quarter.

The CPI groups that contain a substantial proportion of items that were previously subject to WST include Alcohol and tobacco, Household furnishings, supplies and services, Transportation, and Recreation. Each of these groups has an above average increase in its experimental CTRM, although it should be noted that automotive fuel prices (which are not affected by the wholesale sales tax problem) are a significant contributor (0.58 points) to the movement in the CTRM for Transportation. Further, for most of these groups, the increase in their CTRM is greater than their corresponding CPI movement, indicating that taxes in the June quarter were higher than in the September quarter. Such a result is clearly implausible, at least for Alcohol and tobacco.

## A MODIFIED CONSTANT TAX RATE MEASURE

The CFTM does not suffer from the WST problem, but as mentioned above, the ABS does not have the necessary information to compile this measure. To do so would require, for each item in the CPI previously subject to WST, information on prices just before or after the imposition of WST (or the margin between the wholesale and final price) for the June quarter 2000 base period.

To give an indication of the extent to which the CTRM is deficient, the ABS has made illustrative CFTM estimates for the Beer and Spirits expenditure classes. Beer and Spirits were chosen for the purpose of the exercise as it is considered that the effect of the WST problem is greatest for these two expenditure classes. The margins information used to calculate these estimates was derived from data reported in the ABS's 1998–99 Retail Industry Survey. While the Retail Industry Survey data are considered to be reasonable for the purpose of making illustrative estimates for these two expenditure classes, they are not suitable for compiling a comprehensive and definitive CFTM as they (a) do not relate to the June Quarter 2000 base period and (b) are at an insufficient level of disaggregation to apply to the wide range of items priced in the CPI.

The impact on the experimental CTRM results of estimating Beer and Spirits using the CFTM are shown in table 2.

**TABLE 2: MODIFIED EXPERIMENTAL CONSTANT TAX RATE MEASURE**

Group	% change June quarter 2000 to September quarter 2000 Change in points contribution		
	CPI	Adjusted CTRM (a)	Adjusted CTRM (a)
Food	1.7	-0.9	-0.20
Alcohol and tobacco	6.5	0.4	0.04
Clothing and footwear	7.4	0.1	0.00
Housing	6.1	0.5	0.11
Household furnishings, supplies and services	2.0	3.3	0.34
Health	0.5	0.2	0.01
Transportation	2.6	6.0	1.15
Communication	6.9	-2.8	-0.11

Recreation	4.0	2.5	0.38
Education	0.2	-0.5	-0.02
Miscellaneous	2.0	2.7	0.14
<b>All groups</b>	<b>3.7</b>	<b>1.4</b>	<b>1.80</b>

(a) Beer and Spirits (part of Alcohol and tobacco) compiled on a CFTM basis, all other items compiled on a CTRM basis.

It can be seen that the effect of measuring Beer and Spirits using the CFTM rather than the CTRM has been substantial, with the change in the All groups measure falling from 2.0% to 1.4%. The implied impact of tax change rises to 2.3 percentage points. While Beer and Spirits are the items likely to have been most affected by the WST problem, many other items are also affected. Even though these effects cannot be quantified, when taken collectively, the impact is likely to be significant. However, if all such effects were able to be identified and removed then the tax impact would be overstated because there would be no allowance for the impact from the reduction in embedded taxes. It is a matter of judgement as to which of these two, offsetting, biases would be most significant. For this reason, the ABS would strongly caution against using the 'adjusted' CTRM result to derive a measure of the effect of TNTS on the CPI.

## CONCLUSION

The ABS has responded to community pressure for an answer to the question **What is the total impact of TNTS on the CPI?** by compiling an experimental CTRM, as it announced it would. The results highlight the ABS's previously expressed reservations about the adequacy of the approach to answer the question, at least for significant components of the CPI. While it is possible to demonstrate to some extent the weakness of the measure, even after modifications it is not possible for the ABS to produce a reliable answer to the question because the methods and data required to do so are not available to the ABS.

Against this background, the ABS has decided not to publish estimates of the measure in subsequent quarters.

## TECHNICAL NOTE

This technical note outlines the equations used to compute the **constant tax rate** and **constant fiscal take** methods for abstracting from tax change. It also outlines the limitations of the measures.

## METHODS OF COMPUTATION

### (a) Constant tax rate measure (CTRM)

This method estimates the price ( $P_t^*$ ) that would have been charged in the current period if the tax rates had not changed as:

$$P_t^* = P_t \frac{(a_0^1 \times a_0^2 \dots \times a_0^n)}{(a_t^1 \times a_t^2 \dots \times a_t^n)} - S_t + S_0$$

where:

$P_t^*$  = estimate of price in period  $t$  at period 0 tax rate,

$P_t$  = observed price in period  $t$ ,

$a_0$  = ad valorem tax rate in period 0, expressed in mark-up form (e.g. a 22% WST = 1.22) while the superscripts allow for more than one ad valorem tax,

$a_t$  = ad valorem tax rate in period  $t$  expressed in mark-up form,

$S_t$  = specific tax/es in period  $t$ ,

$S_0$  = specific tax/es in period 0.

When specific taxes are involved, the prices need to be expressed in terms of the quantum to which the specific tax relates (e.g. per litre of petrol).

The measure of price change at constant tax rates is given by the ratio of  $P_t^* / P_0$ . The equivalent CPI measure is given by  $P_t / P_0$ .

### (b) Constant fiscal take measure (CFTM)

This method estimates the price that would have been charged if the amount of tax collected had not changed as:

where:

$$P_t^* = P_t - T_t + T_0$$

$P_t^*$  = estimate of price in period  $t$  at period 0 tax rate,

$P_t$  = observed price in period  $t$ ,

$T_0$  = the amount of tax in period 0,

$T_t$  = the amount of tax in period  $t$ .

## LIMITATIONS OF THE MEASURES

There are three main limitations of the CTRM. The first biases the measure downwards (i.e. the impact of tax change is overstated). The second and third bias it upward. The CFTM only suffers from the first limitation.

### (1) Treatment of embedded taxes

Embedded taxes are taxes paid on intermediate goods that make up part of the final price of products. For example tax on fuel affects transportation costs, which flows through to the prices on supermarket shelves. As it is expected that second and subsequent round effects resulting from the removal of many embedded taxes will have a downward influence on prices, the measures will overstate the effect of tax change on the CPI (i.e. produce a lower  $P_t^* / P_0$  than should be the case). In the CTRM, any change in embedded tax is attributed to factors other than tax change. This is illustrated in the example in table 1, which compares final prices in two periods. The only difference between the base and comparison period is the removal of the embedded taxes.

**TABLE 1: EXAMPLE - TREATMENT OF EMBEDDED TAXES**

	Base period (\$)	Comparison period (\$)	Change (%)
Base price	49.00	49.00	
Embedded tax	1.00	0.00	

Ad valorem tax (@ 10% of base price plus embedded tax)	5.00	4.90	
<b>Final price</b>	<b>55.00</b>	<b>53.90</b>	<b>-2.0</b>
Price, constant fiscal take method	55.00	54.00	-1.8
Price, constant tax rate method	55.00	53.90	-2.0

The CTRM in the comparison period is \$53.90 (i.e.  $53.90 \times 1.1/1.1$ ) — the same as the final price. Therefore, none of the price reduction between the two periods is attributed to tax change, when all of it should be (i.e. the effect of tax change is calculated as 0%, when it should have been calculated as -2.0%).

The extent of bias attributable to this limitation will be proportional to the extent of embedded taxes (that are subsequently removed) in final prices.

The CFTM suffers the same limitation, although to a lesser extent.

## (2) Treatment of WST

For items where a WST has been replaced by the GST, the CTRM will bias downwards the impact of tax changes (i.e. produce a higher  $P_t^* / P_0$  than should be the case). This is because the methodology treats a 10 % WST the same as a 10% GST when, all other things being equal, the latter represents a higher effective rate. This is because the GST is applied at a later stage of the production/ distribution chain. A 10% GST levied on any particular item would raise more tax than a 10% WST levied on the same item. In the absence of any other price changes, the replacement of a 10% WST with a 10% GST would therefore cause an increase in the final selling price. The magnitude of the bias will increase with the size of retail and other margins, and with the size of the WST.

Table 2 illustrates the impact of using the constant tax rate and constant fiscal take methodologies for items that were previously subject to WST. The results shown have been derived using two different scenarios of fixed proportional margins and fixed dollar margins, assuming no change to the base price.

**TABLE 2: EXAMPLE-TREATMENT OF WST**

	Base period	Comparison period	Change
Assume proportional margins			
Base period	\$100.00	\$100.00	
WST rate	22%	0%	
WST	\$22.00	\$0.00	
Proportional margin rate	20%	20%	
Margin	\$24.40	\$20.00	
GST rate	0%	10%	
GST	\$0.00	\$12.00	
<b>Final price</b>	<b>\$146.40</b>	<b>\$132.00</b>	<b>-9.8%</b>
Price, constant fiscal take method	\$146.40	\$142.00	-3.0%
Price, constant tax rate method	\$146.40	\$146.40	0.0%
Assume fixed margins			
Base period	\$100.00	\$100.00	
WST rate	22%	0%	
WST	\$22.00	\$0.00	
Margin	\$24.40	\$24.40	
GST rate	0%	10%	
GST	\$0.00	\$12.44	
<b>Final price</b>	<b>\$146.40</b>	<b>\$136.84</b>	<b>-6.5%</b>

Price, constant fiscal take method	\$146.40	\$146.40	0.0%
Price, constant tax rate method	\$146.40	\$151.77	3.7%

In the case of proportional margins, the CTRM shows no change when clearly one of the non-tax components of the final price (the margin) has fallen while the other non-tax component (the base price) has remained constant. The fall in the overall non-tax part of the final price is clearly captured by the CFTM.

In the case of fixed margins the CTRM shows an increase, whereas the two non-tax components of the final price have remained constant. Again the CFTM is the preferred measure.

### (3) The effect of 'fiscal drag'

'Fiscal drag' occurs when ad valorem taxes are applied to changing pre-tax prices. In the example below, an ad valorem tax is applied to a base price. The ad valorem tax rate remains constant, but the pre-tax price increases between the base period and the comparison period.

**TABLE 3: EXAMPLE - EFFECT OF 'FISCAL DRAG'**

	Base period	Comparison period	Change
Pre-tax price	\$100.00	\$110.00	
Ad valorem tax	10%	10%	
Dollar value of tax	\$10.00	\$11.00	
<b>Final price</b>	<b>\$110.00</b>	<b>\$121.00</b>	<b>10.0%</b>
Price, constant fiscal take method	\$110.00	\$120.00	9.1%
Price, constant tax rate method	\$110.00	\$121.00	10.0%

Using a constant tax rate methodology, the constant tax rate price in the comparison period is \$121 (i.e.  $121 \times 1.1/1.1$ ) — the same as the final price. Therefore, none of the price increase between the two periods is attributable to tax changes. However, of the \$11 increase in the final selling price, \$1 was caused by an increase in tax, with the remaining \$10 caused by changes in the non-tax component. Using a constant fiscal take methodology, the change in prices attributable to non-tax changes is 9.1% (i.e.  $(121 - 11 + 10)/110$ ). The difference between this and the actual movement in the final selling price (10%) is attributable to the 'fiscal drag' associated with the levying of an ad valorem tax on a changing pre-tax price.

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